PREVENTIVE CONSERVATION WORKS *IN SITU* ON POTTERY KILNS FROM XIVTH CENTURY IN VORNICENI (REPUBLIC OF MOLDOVA)

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Discovered by chance in 2013 and researched during the diggings that took place in 2013 and 2014, the medieval pottery kilns in Vorniceni[1] have had, since the beginning a special status. The kilns are situated inside the territory of the village, in the slum called *Gura Văii*, behind Maria Diaconu's old house. The kilns have two ovens for burning pottery, each of them having an opening for the fuel to be poured in and several holes where the discarded ceramics (fig 1).

Both holes for the discarded ceramics look like hollowed rooms in front of the ovens. They are oval shaped, are clayed and still keep traces of the wood that burnt on the spot (these traces are even more visible in the hole in front of oven no. 2) and have burnt clay elevated brims. The walls surrounding the holes have a variable conserved height oscillating from 5 to 25 cm.

The ovens themselves have a similar construction and approximately the same dimensions. The architecture of both ovens is straightforward. They have conserved in elevation their almost tapered shape, with walls slightly arched

[1] V. Vornic, S. Tabuncic, *Două cuptoare de olărie din sec. XIV descoperite la Vorniceni*, in *Arheologia Preventivă în Republica Moldova*, I, 1-2, 2014, p. 116.

towards the inside. All the pieces, the door of the oven, the fireplace, the burning chambers (what was left of them) and the reverberation plates have similar shapes and sizes.

The characteristics that archaeologists have already described show a normal variation of dimensions of the different components as well as in the current interventions meant to repair the ovens. Apparently, the same *modus operandi* was used for building both of the ovens. This means that for a while they functioned together as an oven battery, which leads us into thinking that at the moment there must have been a great request for ceramic vessel. The important quantity of potsherd in the holes near the ovens seams to confirm this hypothesis.

Due to the specific conditions of an archaeological open complex the evaluation of the state of preservation (anamnesis[2] and etiopathogeny) will refer to the entire area: the two ovens and the space around them.

This evaluation is an important step in establishing a history of the behaviour the constituent material of the conserved object, its interaction with the anthropic factor in the time the ovens were working, up to the present day. The evaluation will also refer to the behaviour of the constituent material in relation to the environment and after being dug out.

Interventions of conservation and restoration have been planned based on this preliminary observation. The analysis of the state of conservation studies the constituent material of the conserved object, the history or the anamnesis of the changes the object has suffered, starting at its construction and ending with the present conditions as well as the etiopathogeny or the causes of degradation.

The material used for constructing the ovens was soil.

The archaeological objective is situated on an inclined terrain, with an east to west[3] inclination. The authors of the archaeological research mention that ... *about 6 m to the north-east of the diggings, up to a couple of years ago, there was a nameless brook that is now completely dried out*". Based on these pieces of information, it may be assumed that the place where the kilns are now used to have a position that has allowed alluvial deposits as far back as the geological eras. In the 14th century this was the ideal place to place a pottery ensemble as it was situated close to water and to fuel.

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[2] C. Georgescu, *Repere istorice în restaurarea patrimoniului. Anamneza şi etiopatogenia patrimoniului arheologic mobil*, in C.-E. Ștefan *et alii* (eds.), *Studii privind preistoria sud-estului Europei. Volum dedicate memoriei lui Mihai Şimon*, Editura Istros, Brăila, 2014, p. 447.

[3] V. Vornic, S. Tabuncic, *op.cit*., p. 122.

Masters used raw material, soil, in its raw shape and dug[4] most of the ovens. Lacking mechanic treatment, the soil kept its natural state. This means that the air holes, the organic material, the vegetable or animal remains as well as the entomofauna remained untouched during the new construction.

The argillaceous soil went through some serious transformation once the burnings started. The quartz in the sand, the limestone fragments and the shells naturally present in the soil acted as grease removers and had the important role of raising the temperature during the burnings.

The first burning, probably without ceramic objects inside, hardened the structure of the oven. By burning the soil, a phenomenon of recrystallization took place similar to the one naturally present in a geological cycle, but with a lower energy input compared to the geological lithification conditions. The quality of the soil changed. Under the effect of high temperatures and having gone through all the steps of transformation f the crystals in its composition the soil became more resistant to mechanical shock.

If the ovens have been dug in the ground, the reverberation plates were made in a different way. They have several layers of soldering manually compacted. In the case of oven number 1, there two even three layers of soldering mixed with straws and chaff[5]. The plate in oven number 2 presents an extra soldering, of circular shape, in the central area, which represents a mend[6]. The reverberation plates of both ovens were made as a grate with five almost equal perforations: a central perforation and four more arranged as the angles of a quadrangle inscribed in the circle of the plate. Due to the way they were processed, the reverberation plates remain the most resistant part of the ovens.

Following the uneven dispersal of heat, the lithification was different in the areas where the contact with fire was direct or it lasted longer. A special effect can be seen in the areas covered in clay. By pressing the soil when the clay was added, the void in the raw soil was compacted and heavier particles (quartz) came to surface. Burning the oven created a vitrified cover. The thickness of the vitrified layer varies. When exposed to incandescent charcoal from the burning, the surface of the clay layer hardened and enclosed the materials that resulted from the burning.

Lithification reached a certain stage as a result of repeated burnings that are common for a ceramics kiln. The vitrified silica found on the reverberation plates (the perforated grade) is the most important witness that high

[4] *Ibidem*, p. 118, 122.
[5] *Ibidem*, p. 118.
[6] *Ibidem*, p. 122, 123, fig. 11.

temperatures between 650-1000°C[7] were reached. The melting point of silica materials is beyond 650°C.

In any intervention of conservation restoration, the first step is to establish the causes and the mechanisms that lead to the degradation of the material that makes the object. In other words, an analysis of the etiopathogeny of the constituent material is required. In the particular case of the pottery ovens, the causes of degradation are both internal and external and have influenced each other.

Internal causes regard the nature of the material that the ovens were made from, the argillaceous soil. The quality of the unprocessed soil did not allow a sufficient and stabile hardening. The fact that the ovens were dug and the surface was lightly processed by adding a layer of clay failed to insure the compaction necessary for a resistant structure.

The roots of plants, the existent void between particles and the entomofauna (nematodes, earth bugs, some arachnids, terrestrial molluscs) remained intact in the structure of the walls.

Traces of these earth worms and of rainworms[8] remained fossilized (fig. 2, 3) in the walls of the ovens. Residues in the old galleries that date back to the 14th century and fill the vertical galleries was formed from the soil that recirculated the intestines of these worms after having ingested the humus ... *from where the rainworms got the animal and vegetal decomposing substances in their food*[9]"

Traces of oligochaetaes may be observed on the horizontal surfaces of the walls, excepting the horizontal surfaces of the reverberation plates. They have a round shape with a diameter of approximately 5 mm (fig. 2/1).

In section, the galleries are vertical or oblique, with slight windings (fig. 2/2). Most of the void galleries collapsed or are about to collapse thus making the frailty of the walls even higher.

Other relics are the nests of the *Limax,* possibly *Limax maximus*, but even more probable, slug of the crops. *Deroceras agrestis*; these terrestrial gastropods lay their eggs in the soil[10]. One of the burnings took place at the time the eggs were being laid leaving the print of the slug *in situ*. (Fig. 2/4).

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[7] M. Bailly, *Le verre. La conservation en Archéologie*, Paris, 1990, p. 121.

[8] A.E. Brehm, *Lumea animalelor*, Bucureşti, 1964, p. 109-114. Rainworms belong, according to the author to the *Phylum Annelida*, class *Arhiannelida-Primitive Annelida*, class *Clitellata-Clitelate*, order *Oligochaetaes-Rainworms*.

[9] *Ibidem*, p. 113.

[10] *Ibidem*, p. 96-98. *Limax maximus* and *Deroceras agrestis*, belong to the *Phylum Conchifera*, class *Gastropoda-Snails*, order *Pulmonata-Pulmonate*.

The burying conditions, once the ovens stopped being used, eventually led to a mechanical and chemical balance between the ovens and the new environment[11]. There was a change in the humidity of the material, the structure of the ovens weakened; the roots of plants worked their way inside the walls of the ovens, causing fissures to appear. The entomofauna transits or nests in galleries inside these fissures, just like in old canals left open. New generations of annelids, gastropods and insects took advantage of these galleries and carried in fresh humus. (fig. 3/1, 2). The reverberation plates of the two ovens suffered less from the movements of the entomofauna. This phenomenon is due to the different kind of mechanical treatment (compacting) applied to them during construction. The humus is a fertile soil, rich in soluble salts, black and very permeable; it is also carries animal galleries (fig. 3/3). The differences between the permeability of the two types of soil increased the degradation processes.

Oven number 1 was affected when it was discovered and it presents a gap in the preserved part of the dome, in the reverberation plate and the fireplace, on the north eastern part of the complex.

After several hundreds of years of adapting and relative stability in the burying environment, exhumation led to rapid changes in parameters such as pressure, temperature, humidity, light. New mechanical contractions of the material occurred as the support granted by the earth was removed.

The sudden change in the aforementioned parameters at the moment of the uncovering, then their permanent variation from day to night and from season to season rapidly affected the state of conservation of the two ovens. The canals filled with humus reacted differently than the burned material, given their higher permeability. Differences in humidity and capillarity as well as in the relative humidity of the environment, determined the pulverulent material to detach in slices and suffer different forms of biodegradation.

Based on the analysis of the state of conservation, the established methodological priorities for the emergency intervention were:

1. Cleaning the area of live soil and dust.
2. Stabilizing and biocidation of the constituent materials of the ovens, of the areas covered in clay and the ones with burned soil. Due to the pulverulent state of the burned soil, stabilization was done by impregnating the soil with a mix of colloidal silica and a wide spectrum biocide. It was decided for the consolidation to be done at the same time with the biocidation in order to avoid supplementary stress on the material. The impregnation was done by pulverization, due to the friable state of the constituent materials.

[11] M. Berdoucou, *La céramique archéologique. La conservation en Archéologie*, Paris, 1990, p. 19-21.

3. Insuring the areas containing detached material and of those affected by entomofauna by applying mortar lime / sand/burned soil / calcium caseinate. In order to determine the level of degradation of elevation of the ovens, trace evidence was used. The orifices and canals were delimited and marked (fig. 4). The digital processing of trace evidence shows that damage in the walls of the ovens had reached maximum level. The density of canals varies from five to ten by square decimetre. Under these conditions of vertical perforation in the walls, combined with oscillating humidity and friable material, the risk of implosion was imminent.
4. Consolidating the walls of the ovens, the delimitations of burnt sol that mark the openings used for the fuel feed and the holes with ceramic fragments. It was proceeded to filling the canals and the gaps (fig. 5/1) by injecting calcium caseinate and fluid lime mortar (fig. 5/2). In that which regards gaps, they have been supplementary insured using props before making the injections.
5. Completing the missing parts with mortar made of lime / sand / burnt soil and calcium caseinate (fig. 5/3) and completing the missing parts on the chromatic integration level.
6. Clearing and cleaning the area and repeating the biocidation and consolidation with colloidal silica. Protecting the stepping level by protecting the footwear.
7. Adding a layer of vernis by spraying.
8. Protecting the kiln for the winter period.

Conserving the archaeological sites on the spot is not a recent praxis in Romania and Moldavia. Traditionally, elevations of different buildings / citadels are conserved and restored. Immobile elements such as installations are usually assembled for the period of the archaeological research, their physical existence ceases.

However, there are some exceptions. Among the installations taken to be conserved in museums there are some bakestones dating from La Tène: found in Popeşti (Giurgiu County), Constanţa (Constanța County) and Cârlomăneşti (Buzău County). Unfortunately, due to the material used in creating them and to a less adequate methodology, problems with the bakestone in Popeşti[12] occurred in the early stage when they were taken.

Despite the fact that many fire installations had been discovered during systematic diggings, almost none of them have been capitalized by being exhibited in museums. Some are still in the deposits of different museums,

[12] Al. Vulpe, *50 years of systematic archaeological excavations at the pre- and protohistoric site at Popeşti*, in *Dacia*, NS, XLVIII-XLIX (2004-2005), 2005, p. 19-37, 48, 49.

where they lay in fragments, as is the case of the bakestone in Popeşti[13]. However, there are some museums that own such structures: The National History and Archaeology Museum of Constanţa, County Museum of Buzău[14], „Valer Literat" Museum of Făgăraş Region[15] etc.

There are even less specialists who dared to approach a method of tapping / conserving / restoring pottery ovens. In 1981, as a premiere in Romania, in the town of Sighişoara, a team of archaeologists[16] decided to tap an oven from the diggings site at *Dealul Viilor*. The oven dated in the 4th century was part of an installation of batteries used to burn ceramics. After being extracted, the oven was exposed in several places throughout the citadel. In 2006, it went into conservation and restoration[17], a project financed by *SICERAM*[18]. Restorer Sorina Parchirie[19] and archaeologist Gheorghe Baltag, reconstructed the oven that had been extracted 20 years before. The restored oven would then be exhibited at the *SICERAM* office.

The second example of conserved ovens, this time *in situ* is in Botoşani. The discovery[20], in 2009, of 11 pottery and metal manufactures from the 15th century, with ovens for burning ceramics and reducing ore was a premiere. The rarity and scientific importance of the discovery determined the start of conservation works on the site. The conservation works are a new approach of the archaeologists towards this sort of installations. The team of archaeologists led by Dr. Florin Hău, together with the expert-restorer Ioan Fărătăiş[21],

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[13] ***http://www.instarhparvan.ro/pagini%20secundare/activitati/santiere/preistorie/popesti/popesti.htm.***

[14] D. Măgureanu, C. Georgescu, *Cercetare-conservare. Traseul unei vetre decorate descoperite în aşezarea de epocă geto-dacică clasică de la Cârlomăneşti*, în *Caiete ARA*, 1, 2010, ***http://www.simpara.ro/Caiete-ARA-1-170.htm.***

[15] Information from V. Vornic.

[16] Gh. Baltag (History Museum of Sighişoara), R. Harhoiu („Vasile Pârvan" Institute of Archaeology of Bucharest), M. Petică (History County Museum of Târgu Mureş).

[17] S. Parchirie, *Restaurarea unui cuptor de ars ceramică (secolul al IV-lea D. HR.)*, in *Alt Schaesburg*, 1, 2008, p. 227.

[18] S.C. SICERAM S.A. Sighişoara, ceramic tiles manufacture, manually and mechanically made bricks that hold a patent for its own masonry system, TERMOBLOC®. It was founded in 1907 and has been working with small brakes until today. In 2005 it was completely retechnologized. See also: ***http://www.siceram.ro/istoria-companiei/.***

[19] I would like to thank Ms. Sorina Parchirie for the constructive discussions and for the materials she put to my disposal.

[20] ***http://adevarul.ro/locale/botosani/cuptoare-1_52d2b652c7b855ff566aa808/index.html.***

[21] I would like to thank Mr. Vladimir Ioan Fărătăiş, as well as Mr. Ioan Mareş, for their kindness and for presenting the conserved site as well as for the technical details regarding the conservation procedures.

managed to find technical solutions[22] in order to conserve this important, so far unique, archaeological kiln.

In Moldavia, the situation regarding similar installations is similar to the situation in Romania. According to a brief piece of information[23], an attempt to conserve a pottery oven discovered in a 15th century site in Lozova and put it into a museum was made in the 1960s.

The scientific importance of the artefacts unearthed in 2013 determined the specialists of the National Archaeological Agency from Republic of Moldova to opt for their preservation.

Starting the interventions for *in situ* conservation / restoration of the two 14th century workshops equipped with ovens for burning ceramics in Vorniceni represents, in many ways, a pioneer work.

The next phase of intervention prepares the long term conservation of the site. The proposal consists of creating a protecting building with local natural materials, so that essential goals are reached: the relative temperature and humidity of the environment on site are to be as stable as possible, achieving dynamic balance around the construction and a pleasant aesthetic presence that is nature friendly.

Soil, straw and lime will be the main materials for creating the protective building around the ovens. By adopting building techniques that use natural materials it is expected to reduce the maintenance costs that the climate maintenance stations – consumers of electrical power – imply. The way in which earth buildings ensure a healthy climate has been studied by important german architects and even represents a recent trend in architecture. Gernot Minke24 is one of the most representative authors and promoter of this architecture that is based on millenary building techniques. For filling the gaps and reconstruction of the missing parts, a mixture of lime mortar and amorphous materials will be used, ensuring the necessary resistance as well as the aesthetic integration with the whole. A reconstruction, based on calculations, of the domes of the chambers for burning ceramics is previewed: light materials on a mobile structure, chromatically harmonized.

The complex approach based on knowing the properties of the materials and the behaviour of the live material, of the interactions between them and the synergy of their properties in the field of conservation can reduce the effort of maintenance after the active intervention of conservation and restoration.

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[22] ***http://stiri.botosani.ro/stire/58621/Cuptoarele+din+Centrul+Vechi,+unicat+%C3%AEn+%C5%A3ar%C4%83!+Vezi+c%C3%A2nd+va+fi+gata+amenajarea+acestora.html.***

[23] L.L. Polevoi, P.P. Burnea, *Srednevekoevye pamyatniki XIV-XVII vv.*, in *Arkheologicheskye Karta Moldavii*, 7, p. 33, 34.

[24] ***https://archive.org/details/Gernot_Minke-Building_With_Earth.***

Conserving archaeological assets *in situ*, though difficult, maintain the object of interest in the space where it initially functioned. In this way, the information remains complete bringing awareness of the identity and responsibility among the community on the territory where it existed.

This way, it becomes an important instrument of education and knowledge.

LUCRĂRI PREVENTIVE DE CONSERVARE *IN SITU* ALE CUPTOARELOR DE CERAMICĂ DIN SECOLUL AL XIV-LEA DE LA VORNICENI (REPUBLICA MOLDOVA)

Cuvinte-cheie: *evul mediu, Vorniceni-„Gura Văii”, cuptoare de ceramică, conservare „in situ”, materiale, istoric, etiologie, identitate, educație.*

Rezumat

Studiul prezintă un set de informații legate de conservarea unor cuptoare pentru arderea ceramicii, descoperite la Vorniceni (raionul Strășeni, Republica Moldova) și datate în sec. XIV.

Lucrările de conservare au debutat cu studierea materialelor din care au fost realizate instalațiile de ardere, dar și transformările suferite de acestea sub impulsul factorilor antropici și climatici. Aceste observații preliminare au creat baza metodologică pentru conservare și restaurare. Unicitatea acestui complex arheologic, dar și buna sa păstrare au necesitat aplicarea unor metode complexe de prezervare, care să permită păstrarea sa in situ.

Pentru conservarea acestor cuptoare s-au parcurs mai multe etape. Într-o primă fază s-a urmărit stabilizarea pereților cuptorului, apoi s-a realizat consolidarea zonelor detașate sau afectate de entomofaună, apoi a urmat injectarea și chituirea fisurilor, integrarea cromatică a intervențiilor de restaurare și aplicarea unor pelicule pentru a asigura impermeabilitatea instalațiilor de ardere.

LISTA ILUSTRAȚIILOR

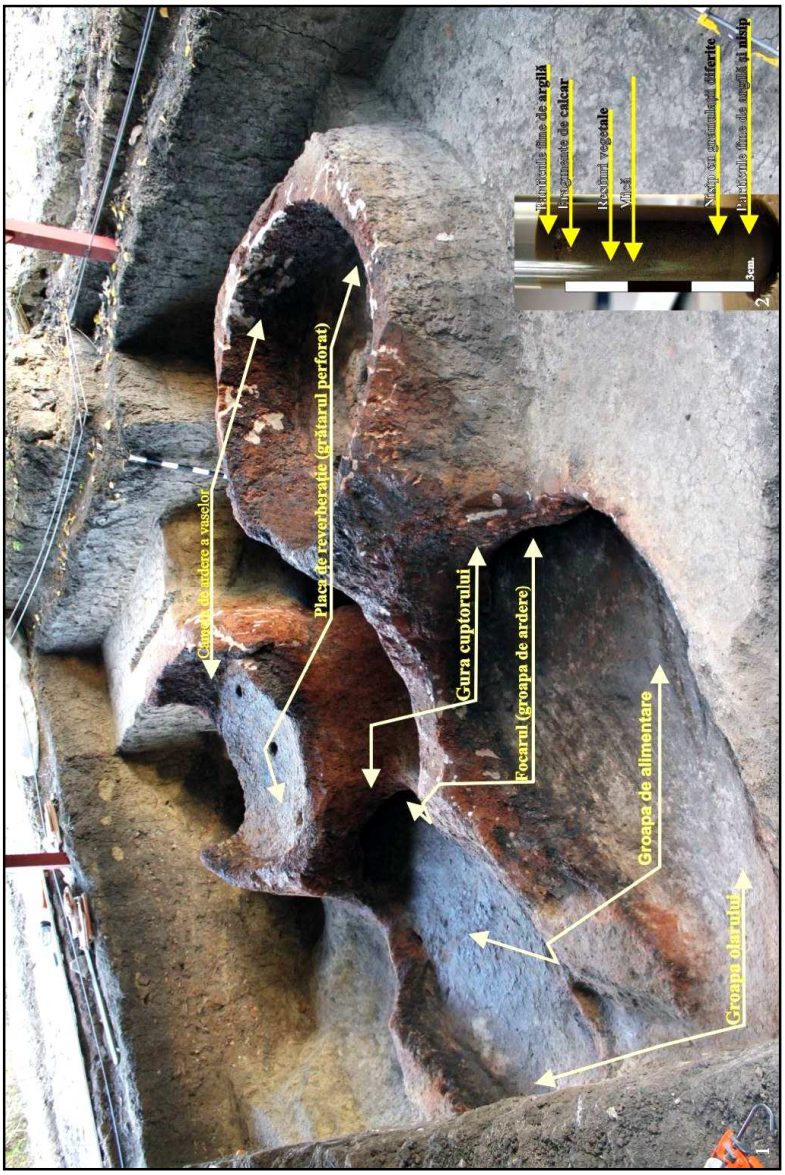

Fig. 1. *Vorniceni-„Gura Văii”. Image of the site:*
1 – construction details of ovens and intervention areas;
2 – compositions of the soil used to build ovens.

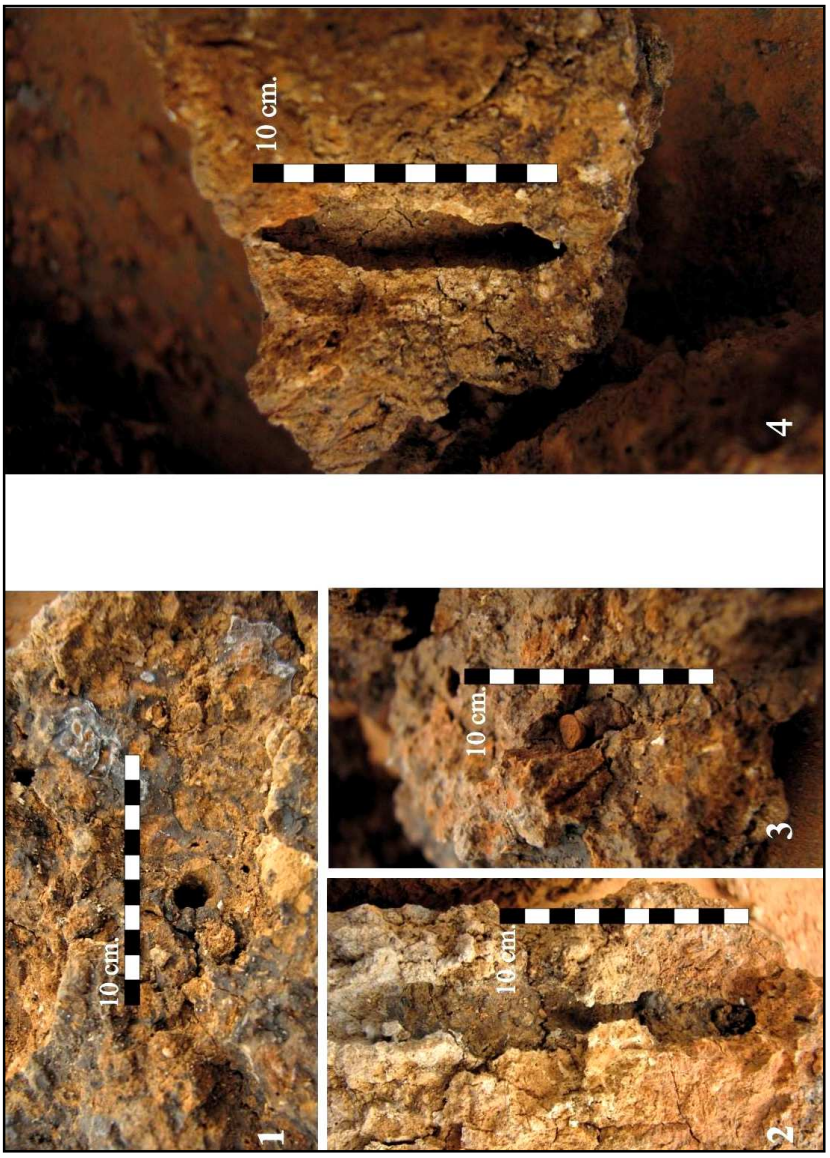

Fig. 2. *Vorniceni-„Gura Văii". Biodegradation from the time the ovens were in use: 1 – exit hole for Annelid, reverberation plates area; 2 – fossil canal made by Annelid; 3 – remaining of Annelid fossilized by burning; 4 – terrestrial mollusk fossilized nest (Slug).*

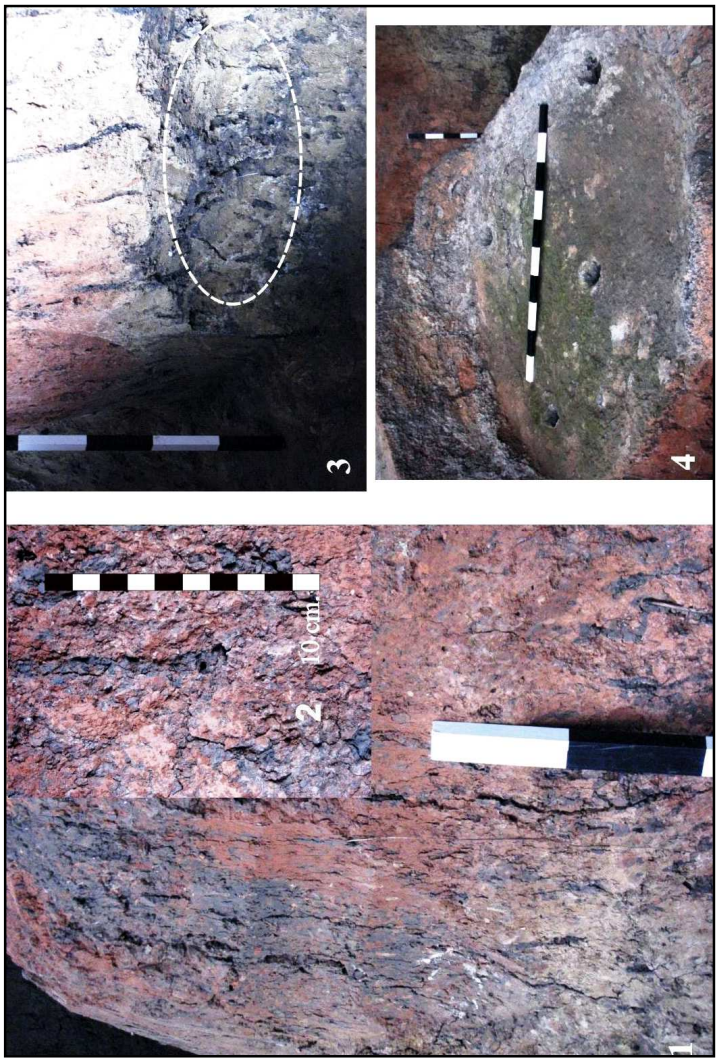

Fig. 3. *Vorniceni-„Gura Văii”. Active biodegradation:*
1 – humus that the entomofauna brought to the walls
after the ovens had been abandoned, fissures in the wall caused by this action;
2 – humus that the Annelids brought into the walls through canals;
3 – humus that small animals brought into the walls of the ovens;
4 – active biodegradation of bryophite (moss)
on the surface of the reverberation plates, proof of high humidity.

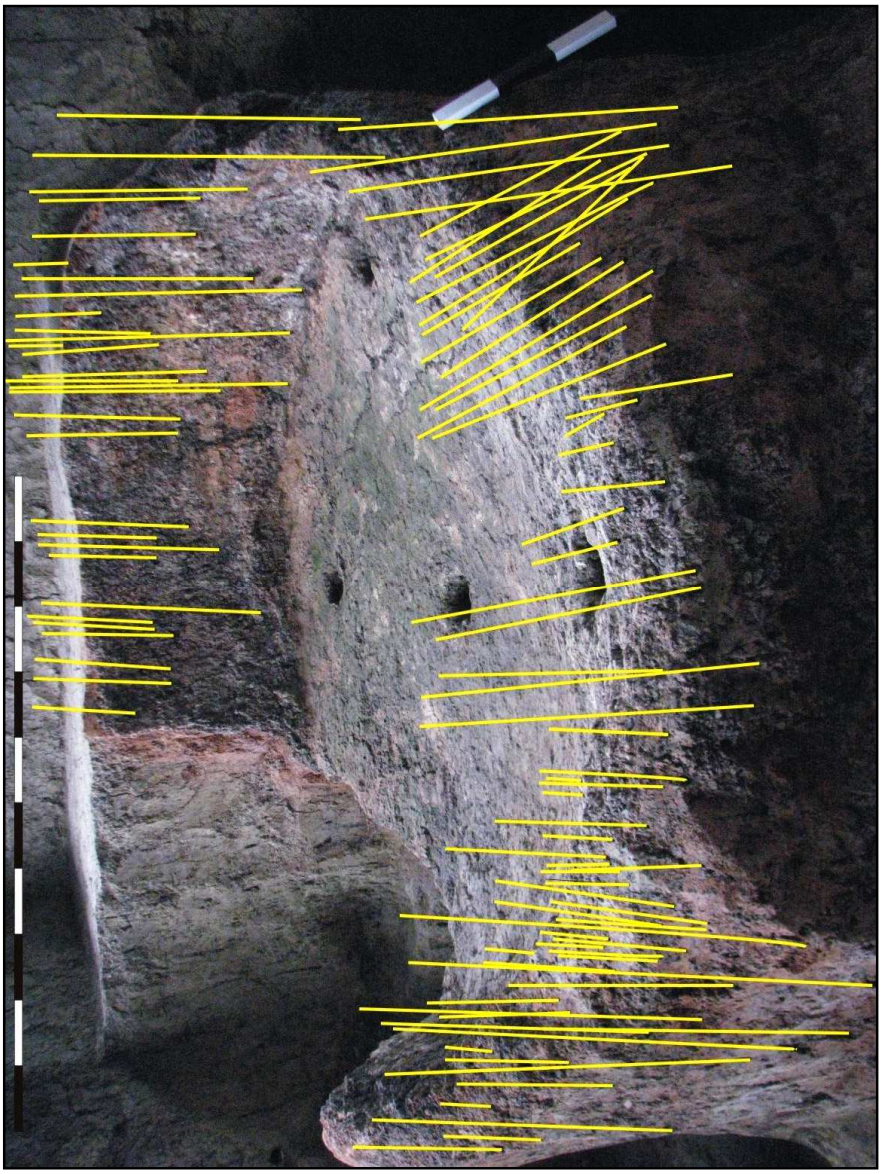

Fig. 4. *Vorniceni-„Gura Văii”.*
Discovery of the presence of the canals using traceology.
Determining densities on the affected surfaces.

Fig. 5. *Vorniceni-„Gura Văii”.*
Intervention of consolidation of fissures on the reverberation plate (oven no. 1):
1 – image before intervention; 2 – injecting fissures in depth;
3 – under the level luting; 4 – luting at the same level with chromatic integration.